

1 **Amendment to the Claims**

2 **In the Claims:**

3 Please cancel Claims 19-21.

4 Please amend Claims 1, 4, 17, 18, 22, 24, 71, 75, and 77 as follows:

5 1. (Currently Amended) A modular system for producing a chemical product from a
6 plurality of reactants comprising:

7 (a) a control module, said control module being adapted to monitor and control
8 production of the chemical product by the modular system, said control module comprising a
9 processor, a reaction database, and a user interface, the control module being configured to enable a
10 user to interact with the user interface to select a specific reaction to produce the chemical product,
11 from a plurality of different reactions stored in the reaction database, so that in response to a selection
12 made by a user, the processor automatically controls the modular system to produce the chemical
13 product according to reaction parameters for the specific reaction that was selected, said reaction
14 parameters being stored in the reaction database;

15 (b) a reactant supply source for each of said plurality of reactants, a flow of each
16 reactant from its reactant supply source being controlled by the control module; and

17 (c) a first reaction module in fluid communication with each reactant supply source to
18 receive each of the plurality of reactants, said first reaction module being controllably connected to said
19 control module and including a reactor, said reactor automatically producing the chemical product from
20 said plurality of reactants under the control of the control module, said reactor comprising a plurality of
21 ~~simple plates, the simple plates being configured such that aligned openings in the plurality of simple~~
22 ~~plates achieve at least two reactant fluid pathways, at least one reaction volume, and at least one product~~
23 ~~fluid pathway~~ stacked in layers, each simple plate having at least one opening that extends therethrough,
24 an opening in each simple plate overlapping at least one other opening in an adjacent simple plate,
25 thereby forming at least one passage within the apparatus for each of said plurality of reactants, such
26 passages merging within the apparatus to form a reaction chamber, the chemical product being formed
27 within said reaction chamber by a reaction between said plurality of reactants, the plurality of simple
28 plates including plates of different thicknesses, such that each simple plate disposed at an uppermost layer
29 and a lowermost layer in the apparatus is substantially thicker than each simple plate disposed between
30 the uppermost layer and the lowermost layer.

1 2. (Previously Presented) The modular system of Claim 1, wherein said reactor is
2 replaceable, and comprises at least one mixing volume.

3 3. (Previously Presented) The modular system of Claim 1, wherein at least one reactant
4 supply source and said first reaction module are configured to accommodate a reactant that is in a
5 gaseous state.

6 4. (Currently Amended) The modular system of Claim 1, further comprising a pump module
7 controllably connected to the control module, said pump module being in fluid communication with
8 each reactant supply source and with said first reaction module, the pump module pumping ~~at least~~
9 ~~one fluid~~ a plurality of fluids through the modular system, the pump module comprising a housing
10 enclosing:

- 11 (a) first reactant pump;
12 (b) a second reactant pump;
13 (c) a heat transfer media pump;
14 (d) a data and power bus;
15 (e) a first valve configured to selectively couple the first reactant pump in fluid
16 communication with a solvent supply and a first reactant supply; and
17 (f) a second valve configured to selectively couple the second reactant pump in
18 fluid communication with the solvent supply and a second reactant supply.

19 5. (Previously Presented) The modular system of Claim 1, further comprising an additional
20 processing module in fluid communication with said first reaction module, said additional processing
21 module being disposed downstream of said reactor, such that the chemical product produced in the
22 reactor passes through said additional processing module.

23 6. (Previously Presented) The modular system of Claim 5, wherein said additional
24 processing module comprises a residence time module in which reaction of the chemical product
25 continues toward completion for a predetermined amount of time.

26 7. (Previously Presented) The modular system of Claim 6, wherein said residence time
27 module comprises a capillary passage of a length selected to obtain the predetermined amount of time
28 for said chemical product in said residence time module.

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1 8. (Original) The modular system of Claim 6, wherein said residence time module comprises
2 a proportional valve, said proportional valve being controllably connected to said control module to
3 selectively vary a pressure within said modular system.

4 9. (Previously Presented) The modular system of Claim 5, wherein said additional
5 processing module comprises a second reaction module in fluid communication with said first
6 reaction module, such that a serial fluid path is created with respect to said first reaction module, said
7 second reaction module being controllably connected to said control module and including a reactor
8 that produces the chemical product from a reaction of said plurality of reactants using a plurality of
9 synthesis steps, a first synthesis step being completed in said first reaction module, and a second
10 synthesis step being completed in said second reaction module.

11 10. (Previously Presented) The modular system of Claim 9, further comprising sufficient
12 additional processing modules, each additional processing module including a reaction module, so
13 that production of the chemical product can be achieved using additional synthesis steps that are
14 completed in succession, each additional synthesis step being completed in a different one of the
15 additional processing modules, the reaction module in each additional processing module being
16 configured to receive a product from a previous additional processing module in which an
17 immediately preceding synthesis step was completed.

18 11. (Previously Presented) The modular system of Claim 1, wherein said reactor is
19 specifically configured to enable it to produce a class of chemical products, and is selectively readily
20 removable from said first reaction module and replacable with a different reactor configured to
21 facilitate the production of a different class of chemical products, thus enabling said modular system
22 to selectively produce different classes of chemical products.

23 12. (Previously Presented) The modular system of Claim 5, wherein said first reaction
24 module further includes a housing, said housing comprising:

25 (a) a first side that includes a plurality of ports enabling said first reaction module
26 to be removably connected to said control module and in fluid communication with said each reactant
27 supply;

28 (b) a second side that includes a plurality of ports enabling said first reaction
29 module to be in fluid communication with at least one of the additional processing module and a
30 product reservoir; and

1 (c) a mounting frame for said reactor, said mounting frame being enclosed within
2 said housing, and being configured to apply a biasing force to secure said reactor in position.

3 13. (Previously Presented) The modular system of Claim 1, wherein said first reaction
4 module comprises means for facilitating production of said chemical product.

5 14. (Original) The modular system of Claim 13, wherein said means include at least one of a
6 heat exchanger, a temperature sensor, and a reactant laminar flow mixing passage.

7 15. (Previously Canceled)

8 16. (Previously Presented) The modular system of Claim 1, wherein said modular system
9 further comprises a plurality of fluid paths, including a fluid path for each of said plurality of reactants, a
10 fluid path for said chemical product, at least one fluid path for a heat transfer media, and at least one fluid
11 path for a spent heat transfer media.

12 17. (Currently Amended) The modular system of Claim 1, wherein said at least one fluid
13 path for said heat transfer media and said at least one fluid path for said spent heat transfer media are
14 configured in ~~one of a parallel fluidic system and a serial fluidic system~~.

15 18. (Currently Amended) The modular system of Claim 4, wherein ~~said pump module~~
16 ~~comprises at least one pump, said at least one pump being~~ each pump in the pump module is
17 controllably connected to said control module to control its operation of the pump.

18 19. (Currently Canceled)

19 20. (Currently Canceled)

20 21. (Currently Canceled)

21 22. (Currently Amended) The modular system of Claim 4, wherein said ~~pump module~~
22 ~~comprises at least one valve, said at least one valve being~~ each valve in the pump module is
23 controllably connected to said control module to control a flow of one of said plurality of reactants to
24 said first reaction module.

25 23. (Previously Presented) The modular system of Claim 4, wherein said pump module
26 comprises at least one filter that filters one of said plurality of reactants before the reactant flows to
27 said first reaction module.

28 24. (Currently Amended) The modular system of Claim 4, wherein said ~~pump module~~
29 ~~comprises a housing, said housing comprising~~ housing comprises:

1 (a) a first side that includes a plurality of ports enabling said pump module to be
2 controllably connected to said control module, and to be in fluid communication with each reactant
3 supply source; and

4 (b) a second side that includes a plurality of ports enabling said pump module to
5 be in fluid communication with said first reaction module.

6 25. (Previously Canceled)

7 26. (Original) The modular system of Claim 4, wherein all connections between modules are
8 achieved using quick connect connectors that enable rapid connection and disconnection of the modules.

9 Claims 27 - 70 (Previously Canceled)

10 71. (Currently Amended) A modular system for producing a chemical product from at least
11 one reactant, comprising:

12 (a) a control module, said control module being adapted to monitor and control
13 production of the chemical product by the modular system, said control module comprising a
14 processor, a reaction database, and a user interface, the control module being configured to enable a
15 user to interact with the user interface to select a specific reaction from a plurality of different
16 reactions stored in the reaction database, so that in response to a selection made by a user, the
17 processor automatically controls the modular system to produce the chemical product according to
18 reaction parameters for the specific reaction ~~selected~~ that was selected, said reaction parameters being
19 stored in the reaction database;

20 (b) a reactant supply source for each reactant used, a flow of each reactant used
21 from its reactant supply source being controlled by the control module; and

22 (c) a first reaction module in fluid communication with at least one reactant supply
23 source to receive said at least one reactant, said first reaction module being controllably connected to
24 said control module and including a replaceable reactor, said replaceable reactor automatically
25 producing the chemical product from said at least one reactant under the control of the control
26 module, said replaceable reactor comprising a plurality of simple plates, ~~the simple plates being~~
27 ~~configured such that aligned openings in the plurality of simple plates achieve at least two reactant~~
28 ~~fluid pathways, at least one mixing volume, at least one reaction volume, and at least one product~~
29 ~~fluid pathway~~ stacked in layers, each simple plate having at least one opening that extends
30 therethrough, a first planar surface, and a second planar surface that is opposite to said first planar

1 surface, both said first and said second planar surfaces being substantially parallel, each simple plate
2 further having edge surfaces extending between said first and said second planar surfaces, such that
3 each opening penetrates said first planar surface and said second planar surface, but not said edge
4 surfaces, an opening in each simple plate overlapping at least one other opening in an adjacent simple
5 plate, thereby forming at least one passage within the apparatus for each at least one reactant, at least
6 one opening defining a reaction chamber being in fluid communication with the at least one passage,
7 the chemical product being formed within said reaction chamber by a reaction involving said at least
8 one reactant, at least one opening defining a heat transfer volume, the heat transfer volume being
9 disposed so as to enable thermal conditioning of at least one of the at least one passage and the
10 reaction chamber, the heat transfer volume being fluidically isolated from the at least one passage and
11 the reaction chamber.

12 72. (Previously Presented) The modular system of Claim 71, wherein said replaceable
13 reactor comprises a microreactor.

14 73. (Previously Presented) The modular system of Claim 72, wherein said at least one
15 reaction volume comprises a plurality of reaction volumes.

16 74. (Previously Presented) The modular system of Claim 1, wherein said reactor comprises a
17 microreactor.

18 75. (Currently Amended) A modular system for producing a chemical product from a
19 plurality of reactants comprising:

20 (a) a control module, said control module being adapted to monitor and control
21 production of the chemical product by the modular system;

22 (b) a reactant supply source for each of said plurality of reactants, a flow of each
23 reactant from its reactant supply source being controlled by the control module; and

24 (c) a first reaction module in fluid communication with each reactant supply
25 source to receive each of the plurality of reactants, said first reaction module being controllably
26 connected to said control module and including a reactor, said reactor automatically producing the
27 chemical product from said plurality of reactants under the control of the control module, said reactor
28 comprising a plurality of simple plates, ~~the simple plates being configured such that aligned openings~~
29 ~~in the plurality of simple plates achieve at least two reactant fluid pathways, at least one reaction~~
30 ~~volume, and at least one product fluid pathway~~ stacked in layers, each simple plate having at least

1 one opening that extends therethrough, an opening in each simple plate overlapping at least one other
2 opening in an adjacent simple plate, thereby forming at least one passage within the apparatus for
3 each of said plurality of reactants, such passages merging within the apparatus to form a reaction
4 chamber, the chemical product being formed within said reaction chamber by a reaction between said
5 plurality of reactants, at least one heat exchanger being defined by an opening in at least one simple
6 plate, and at least one simple plate immediately adjacent to an opening defining at least one of the at
7 least one heat exchanger having a thickness of at least about 0.2 millimeters and not more than about
8 0.6 millimeters.

9 76. (Previously Presented) A modular system for producing a chemical product from a
10 plurality of reactants comprising:

11 (a) a control module, said control module being adapted to monitor and control
12 production of the chemical product by the modular system;

13 (b) a reactant supply source for each of said plurality of reactants, a flow of each
14 reactant from its reactant supply source being controlled by the control module; and

15 (c) a first reaction module in fluid communication with each reactant supply
16 source to receive each of the plurality of reactants, said first reaction module being controllably
17 connected to said control module and including a replaceable reactor automatically producing the
18 chemical product from said plurality of reactants under the control of the control module, said
19 replaceable reactor comprising a plurality of simple plates stacked together in layers, each simple
20 plate comprising a first planar surface, and a second planar surface that is opposite to said first planar
21 surface, both said first and said second planar surfaces being substantially parallel, each simple plate
22 further having edge surfaces extending between said first and said second planar surfaces, said
23 reactor including at least two chemical reactant inlet ports and at least one product outlet port for the
24 receipt and discharge of a chemical product, each chemical reactant inlet port and each product outlet
25 port being defined by an opening in a simple plate that penetrates the first planar surface and the
26 second planar surface of the simple plate, but not the edge surfaces of the simple plate, said reactor
27 further including at least two inlet pathways for accommodating the chemical reactants, wherein each
28 inlet pathway is connected in fluid communication with a different one of said chemical reactant inlet
29 ports, said at least two inlet pathways merging within the reactor to form at least one reaction
30 chamber in which at least two chemical reactants can react to generate a chemical product, at least

1 one outlet pathway coupling said at least one reaction chamber in fluid communication with said at
2 least one product outlet port, and wherein each chemical reactant inlet port, inlet pathway, reaction
3 chamber and product outlet port comprises an opening through at least one simple plate aligned with
4 at least a portion of an opening through an adjacent simple plate.

5 77. (Currently Amended) A modular system for producing a chemical product from a
6 plurality of reactants comprising:

7 (a) a control module, said control module being adapted to monitor and control
8 production of the chemical product by the modular system;

9 (b) a reactant supply source for each of said plurality of reactants, a flow of each
10 reactant from its reactant supply source being controlled by the control module; and

11 (c) a first reaction module in fluid communication with each reactant supply
12 source to receive each of the plurality of reactants, said first reaction module being controllably
13 connected to said control module and comprising:

14 (i) a housing;

15 (ii) a mounting frame disposed within the housing, the mounting frame
16 being configured to support a reactor, the mounting frame comprising a plurality of plates, at least
17 one of which is fixed in position, and at least one of which is moveable, the at least one movable of
18 the plurality of plates enabling the reactor to be removed from the mounting frame; and

19 (iii) a replaceable reactor supported by the mounting frame, said replaceable
20 reactor automatically producing the chemical product from said plurality of reactants under the
21 control of the control module, said replaceable reactor comprising a plurality of simple plates, the
22 simple plates being configured such that aligned openings in the plurality of simple plates achieve at
23 least two reactant fluid pathways, at least one mixing volume, at least one reaction volume, and at
24 least one product fluid pathway.